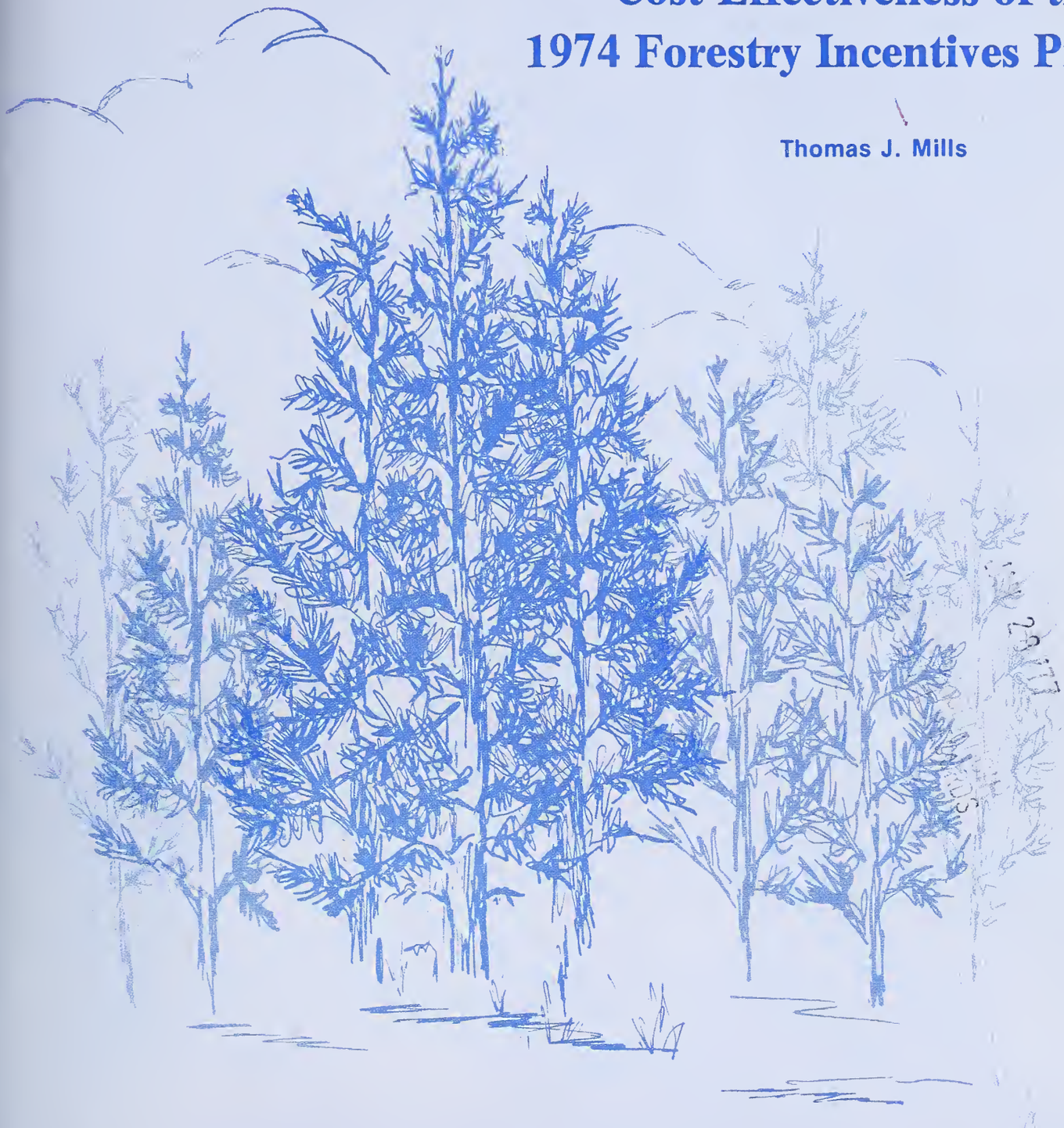
USDA Forest Service
Research Paper RM-175

October 1976

Cost Effectiveness of the 1974 Forestry Incentives Program

Thomas J. Mills



Rocky Mountain Forest and
Range Experiment Station
Forest Service
U.S. Department of Agriculture
Fort Collins, Colorado 80521

Abstract

Mills, Thomas J.
1976. Cost effectiveness of the 1974 Forestry Incentives Program. USDA For. Serv. Res. Pap. RM-175, 23 p. Rocky Mt. For. and Range Exp. Stn., Fort Collins, Colo. 80521.

The Forestry Incentives Program (FIP) is a new cost-sharing program different from its predecessors in that its primary goal is the cost-effective production of timber rather than soil and water conservation in general. The first-year (1974) performance of FIP is analyzed with respect to four indicators of cost effectiveness: the practice and forest type to which it is applied, tract size, total cost per acre, and site class. The performance on the majority of the acres treated was good. Four recommendations are made which should minimize specific problems and further enhance FIP's ability to produce timber cost effectively.

Keywords: Forest economics, Forestry Incentives Program, farm forestry, investments (timber).

Acknowledgments

Due to the size of the data base and the interagency cooperation required for data collection, numerous people contributed to this study. Special thanks are due to Duane Green, Daria Cain, and Jim Space of Cooperative Forestry, USDA Forest Service, and to Gardner Smith and Orin Hanson of the Agricultural Stabilization and Conservation Service (ASCS) for their extensive help and advice. Thanks are also extended to the ASCS county offices and the State service foresters for reporting the necessary data.

USDA Forest Service
Research Paper RM-175

October 1976

Cost Effectiveness of the 1974 Forestry Incentives Program

Thomas J. Mills, Forest Economist[1]
Rocky Mountain Forest and Range Experiment Station

[1]*Central headquarters maintained in Fort Collins, Colorado, in cooperation with Colorado State University.*

Contents

Cost Effectiveness of the 1974 Forestry Incentives Program

Thomas J. Mills

HIGHLIGHTS OF RESULTS AND RECOMMENDATIONS

An estimated $8.3 million in Federal cost shares was expended in 1974 through the Forestry Incentives Program (FIP). A total of 257,000 acres were treated with an average tract size of 16.2 acres. Two-thirds of the cost-share funds were expended in the South, and roughly half of the total acres treated involved planting southern pines. One-half of the acres treated were in land ownerships in excess of 200 acres; size of the tract treated increased with the size of the ownership. Vendors or contractors usually installed the practice, especially the planting practices.

When measured by the four cost-effectiveness indicators, the performance of 1974 FIP is generally favorable. Apparent problem areas are extensive enough, however, to warrant changes in program guidelines. Four recommendations are proposed. First, tract size should exceed 10 acres, with the possible exception of treatments of high-quality hardwoods. Second, maximum cost-per-acre limits should be set in accordance with costs that produce acceptable financial returns—such as 5 percent return—and commensurate with the availability of low-cost investments. Third, the reasons for the rather sizable per-acre cost variation should be determined. Fourth, a new funding apportionment procedure should be developed which incorporates information on ability to deliver the program and cost effectiveness of what was delivered.

INTRODUCTION

Title X of PL 93-86 authorizes the Secretary of Agriculture to share the costs of forestry practices with nonindustrial, private forest landowners. The legislative intent behind the program (Sikes 1973), subsequently named the Forestry Incentives Program (FIP), and the wording of the act itself (U.S. Congress 1973) prescribed several program goals. Although protection and production of forest-related benefits are mentioned, timber production is the primary program goal.

Administrative decisions during the formulative stages of FIP also mentioned nontimber goals, such as soil conservation and enhancement of recreation opportunities and wildlife habitat, but they further emphasized the timber production goal. (U.S. President 1973, USDA Secretary of Agriculture 1973, USDA-FS 1974, USDA-ASCS 1974, Mills et al. 1974).

Since increased timber production is the primary goal, it should logically be achieved at the least cost. In fact, the President's (1973) directive when he signed the legislation, called for a cost-effective timber production program.

The legislation restricts cost-sharing participation to owners of less than 500 acres of forest land unless a special waiver is approved by the Secretary. Participation is further restricted administratively to land with a potential to produce in excess of 50 cubic feet of timber per acre per year, and, in the case of tree planting, to owners who have not commercially harvested timber on the cost-shared land in the previous 5 years. The Federal share of the cost can range from 50 to 75 percent.

The program is jointly administered by three agencies. The USDA Forest Service (FS) provides technical program input such as practice specifications and recommendations on funding apportionment procedures. The USDA Agricultural Stabilization and Conservation Service (ASCS) has administrative responsibility, and handles eligibility, waiver procedures, and payment to applicants. State forestry agencies and private forestry consultants provide technical assistance to the landowner, and State forestry personnel check the installed practice to see that it complies with practice guidelines.

Study Objectives

This study had two objectives. The first was to provide a fairly detailed description of the expenditure and practice composition of 1974 FIP. Accounting data usually compiled for such programs contain little information about the distribution of acres treated by detailed practice categories, for example; yet such information is basic to an understanding of program accomplishments. The 1974 program composition is described under "Cost Effectiveness of Major Program Components."

The second study objective was to provide a first-stage estimate of 1974 FIP's performance in producing timber cost effectively. Past studies have identified the type of timber investments that are financially desirable versus those that are not. FIP's cost effectiveness in providing timber production was evaluated by comparing the type of investments made with what is already known about investment profitability. Four cost-effectiveness indicators were used: the practice and forest type to which it was applied, tract size, site class, and per-acre cost.

This first-stage performance evaluation should identify any problem areas extensive enough to warrant guidelines or regulations similar to the one for site class. Possible program structure modifications are discussed under "Conclusions and Recommendations."

The data base developed to meet these two objectives consist of 15 items on each individual tract treated. A tract is defined as the contiguous acreage held by one participant where the same dominant practice was applied. This makes the investment, instead of the participant, the unit of observation. The detailed information on the first-stage analysis provides cost-effectiveness indicators for each tract.

ASCS helped design the data request, and the ASCS county offices, in cooperation with the State service foresters, reported the data. Because the program was started late in 1974, a "substantial completion" rule was permitted for cases not complete as of December 31, 1974. Tables in this Paper show the program data as of July 1, 1975, for both completed and "substantially completed" cases. At that time, treatments on 88 percent of the acres for which 1974 funds were obligated were completed; treatments on the remaining 12 percent were "substantially completed."

There was some hesitation in selecting the first year of the program for evaluation. The program was started late and attempted to deliver a large appropriation through a funnel of three cooperating agencies. The Presidential requests for funding rescission in 1975 and 1976, however, made the timetable for any "typical year" questionable. Since an early evaluation was needed, and since program structures tend to become fixed over time, the first year was selected for evaluation in spite of any anomalies it might contain.

Overall FIP Evaluation

This study covers only the first stage of the FIP evaluation. Although it provides a valuable, quick description of program composition and measures performance against four cost-effectiveness indicators, other performance information needs are: estimates of the increased timber production resulting from the FIP investments, estimates of their financial return, and estimates of whether the practices were successfully installed. The second-stage evaluation that is currently planned will provide this information through detailed examination of a sample of the 1974 FIP tracts.

Important assumptions must be made in the second-stage evaluation concerning the application of intermediate treatments and retention of the practice until financial maturity. Limited past studies indicate that such assumptions may be weak. Therefore, the third-stage evaluation that is planned will involve long-term monitoring of a sample of the 1974 FIP cases. This monitoring may result in adjustments of the second-stage results, and will document the incidence and amount of poor followthrough on cost-shared practices. It may also lead to recommendations as to where followup assistance is most crucial or, alternatively, where initial practice cost-sharing should be avoided in the future.

Related Studies

There have been several case studies of related public cost-share programs. Manthy (1970) analyzed Agricultural Conservation Program (ACP) forestry practices in selected counties in Pennsylvania. The average tract size of timber stand improvement investments in that study was only 10 acres; plantations averaged less than 8 acres and often contained more than one species. Mendel (1967) conducted a similar study of ACP investments in southeastern Ohio. While the average timber stand improvement was 18 acres, tree planting practices averaged less than 5 acres. Gregersen et al. (1975), in a study of 1972 Rural Environmental Assistance Program (REAP) tree-planting (A-7) in Minnesota, estimated that 41 percent of the acreage studied could not provide an acceptable return on investment costs—6 7/8 percent in their study.

Benson and Skok's (1960) analysis of Soil Bank plantings in Minnesota revealed a larger average tract size of 12 acres. The majority of the participants, however, had no future plans for the plantations. This failure to make plans for necessary intermediate treatments is apparently common among owners in the North. Kingsley and Mayer (1972) found that 89 percent of the conifer plantations in West Virginia, Delaware, Kentucky, Maine, Connecticut, and New Jersey were seriously overstocked, and that many

suffered from hardwood and brush invasion. They observed that ". . . most of the plantations in the region were planted—and that is all that was ever done to them."

Williston and Dell (1974) also found a hardwood competition problem in Civilian Conservation Corps (CCC) plantations in northern Mississippi, although not as severe; 19 percent of the area suffered from hardwood invasion. Williston (1972) found that hardwood invasion was responsible for failure of 7 percent of 3,875 Yazoo-Little Tallahatchie (Y-LT) plantations checked in northern Mississippi.

Even when overstocking and hardwood invasion are not problems, premature harvesting and conversion to other land uses is a threat to the initial investment. For example, one-third of the privately owned CCC plantations checked in northern Mississippi by Williston and Dell were removed prematurely over a 10-year period. Most were converted to pasture in spite of the questionable suitability of the sites for pasture. Similarly, 6 percent of the Y-LT acreage analyzed by Williston was harvested for posts or pulpwood in spite of their low merchantability, 4 percent was cleared for pasture, and 2 percent was lost through miscellaneous factors such as road construction and conversion to row crops.

When natural losses are added to the problems of small tract sizes, failure to follow through with the necessary intermediate treatments, and failure to hold the initial investment until financial maturity, these studies of related assistance programs do not depict a rosy picture for the potential success of the new incentives program. In fact, skepticism has already been expressed that FIP can be cost effective (Duerr 1974, Zivnuska 1974).

While FIP's goal may be difficult to attain, condemning it to failure because of the performance of earlier assistance programs is premature (Mills 1975). These studies evaluated programs designed primarily for soil and water conservation. Therefore, it should not be surprising that timber production performance was found wanting.

The geographic scope of these studies was also limited. A broader base is necessary before redirection of a national program can be proposed.

PROGRAM SCALE AND COMPOSITION

The general composition and size of the 1974 program can be described by several factors.

Expenditures and Acres Treated

In 1974 FIP, $8.3 million was spent for Federal cost-shares (table 1). An additional $0.9 million of appropriated funds was spent on technical assistance. This estimated Federal spending was 30 percent less than the $12 million total available for FIP from the 1974 Rural Environmental Assistance Program (REAP) (USDA Secretary of Agriculture 1973). The 1974 FIP Federal spending was also 12 percent less than the 1972 REAP obligations for tree planting and timber stand improvement practices.

North Carolina spent by far the most Federal cost-share funds (19.6 percent), followed by Georgia (10.0 percent), Alabama (7.6 percent), Mississippi (5.0 percent), South Carolina (4.6 percent), and Texas (4.4 percent). The combined southern States spent 66.0 percent of the total funds, followed by the Central region (13.7 percent), the Northeast (10.0 percent), the Lake States (5.4 percent), the Pacific Coast (2.8 percent), and the Plains and Rockies (2.1 percent).

The estimated total spending, Federal plus private share, was $11.3 million on treatment application. The average Federal cost-share rate for the program was estimated at 73 percent. Virginia used a 50 percent cost-share on all tracts; Minnesota had varying rates and an average of 60 percent. A few other States (Illinois, New Hampshire, Rhode Island, and Vermont) had 50 percent rates on selected practices. The rest of the States used the maximum allowed by the legislation—75 percent. (More States are shifting to less than 75 percent cost-share rates in 1976 as it becomes apparent that more FIP participation can be generated at the 75 percent rate than there are funds to service.)

A total of 13,500 owners participated in 1974 FIP involving 15,849 separate tracts. A total of 257,033 acres were treated or are "substantially completed." The overall average Federal cost per acre was $32 on an average tract size of 16.2 acres. The average total cost, Federal plus private share, was $43 per acre.

The percentage of total Federal cost-shares obligated by State compares fairly closely with the original apportionment of funds. In 1974, 40 percent of the total appropriation was held in reserve at the national level. Funds originally earmarked for States that could not obligate their entire apportionment were reallocated to States that could deliver more than their original apportionment. Some States spent more, most notably North Carolina, Georgia, New Hampshire, and Maine. Likewise, some States spent less, notably Virginia, Kentucky, Tennessee, Pennsylvania, West Virginia, Texas, and Alabama.

There are several reasons for the differences between the amounts apportioned and actually obligated. States varied in: (1) the rapidity with which they could implement programs, especially since State funds were frequently needed to augment FIP funds; (2) availability of vendor services and tree planting stock; (3) the percent cost-share rate used; (4) accuracy of regional data used to estimate the existence of treatment opportunities; and (5) the use of the "substantial completion" rule.

Table 1.--Spending, acres treated, and tract characteristics for the 1974 Forestry Incentive Program

Region and State	Apportionment	Federal spending[1]		Acres treated[2]		Tree planting[3]		Intermediate treatments[4]	
		Amount	Percentage	Amount	Percentage of total	Average cost per acre[5]	Average size per tract	Average cost per acre[5]	Average size per tract
	%		%	Acres	%		Acres		Acres
SOUTH									
Alabama	9.0	$ 626.7	7.6	17,067	6.6	$50	23.7	$26	28.0
Arkansas	4.4	264.2	3.2	12,128	4.7	36	21.1	25	31.6
Florida	1.9	226.0	2.7	7,077	2.8	44	22.0	14	14.8
Georgia	7.6	824.8	10.0	27,198	10.6	44	30.5	19	62.8
Louisiana	2.7	295.2	3.6	11,508	4.5	37	25.0	27	37.3
Maryland	1.1	89.3	1.1	1,900	.7	72	17.2	35	18.7
Mississippi	5.9	414.8	5.0	15,904	6.2	39	16.1	19	29.1
North Carolina	8.4	1,618.6	19.6	28.022	10.9	79	17.6	39	15.5
Oklahoma	1.6	72.0	.9	3,969	1.5	50	18.3	18	57.8
South Carolina	4.7	378.2	4.6	9,201	3.6	68	25.6	5	56.9
Texas	7.3	360.1	4.4	9,816	3.8	56	21.8	28	45.6
Virginia	7.1	285.0	3.4	15,060	5.9	41	21.2	15	31.5
Total	61.6	5,454.9	66.0	158,850	61.8	53	21.5	23	35.0
CENTRAL									
Illinois	.8	80.9	1.0	2,471	1.0	67	6.1	41	13.2
Indiana	.9	77.1	.9	4,453	1.7	34	6.0	21	24.6
Iowa	.5	28.5	.3	721	.3	62	3.9	37	10.5
Kansas	.5	49.3	.6	1,204	.5	75	6.6	48	11.4
Kentucky	4.3	121.2	1.5	4,066	1.6	34	10.1	39	12.5
Missouri	2.8	255.5	3.1	16,704	6.5	43	13.6	19	35.6
Nebraska	.5	84.6	1.0	1,411	.5	133	4.6	69	19.6
Ohio	2.0	183.7	2.2	4,709	1.8	43	9.7	47	18.2
Tennessee	4.4	134.9	1.6	4,439	1.7	71	17.3	22	23.1
West Virginia	2.9	118.4	1.4	4,391	1.7	47	3.2	23	12.3
Total	19.5	1,134.1	13.7	44,569	17.3	52	6.8	27	21.7
NORTHEAST									
Connecticut	.5	33.7	.4	626	.2	48	6.6	41	7.1
Delaware	.2	18.4	.2	340	.1	72	21.3	--	--
Maine	.5	123.1	1.5	4,571	1.8	48	7.0	27	8.1
Massachusetts	1.0	78.1	.9	2,910	1.1	--	--	34	12.9
New Hampshire	.5	133.2	1.6	4,078	1.6	19	7.6	41	9.3
New Jersey	.5	34.8	.4	2,193	.9	16	10.8	27	7.6
New York	2.0	153.7	1.9	5,386	2.1	49	9.5	36	9.4
Pennsylvania	3.8	189.7	2.3	5,360	2.1	42	4.4	48	11.2
Rhode Island	.1	4.5	*	74	*	43	6.0	64	7.0
Vermont	.6	55.9	.7	2,963	1.2	60	1.0	26	16.5
Total	9.6	825.1	10.0	28,501	11.1	41	6.5	36	10.2
LAKE STATES									
Michigan	1.9	233.4	2.8	10,715	4.2	33	8.4	26	12.9
Minnesota	.7	75.9	.9	2,354	.9	55	3.7	44	9.2
Wisconsin	1.4	138.2	1.7	4,872	1.9	45	6.4	23	8.5
Total	3.9	447.5	5.4	17,941	7.0	41	6.1	26	11.6
PLAINS AND ROCKY MOUNTAINS									
Arizona	.2	12.1	.1	398	.2	35	7.5	41	29.5
Colorado	.5	44.6	.5	632	.2	--	--	90	21.8
Idaho	.5	23.5	.3	329	.1	135	6.5	94	16.6
Montana	.5	36.3	.4	577	.2	62	34.0	78	11.1
Nevada	.2	.8	*	6	*	178	6.0	--	--
New Mexico	.2	14.3	.2	518	.2	70	12.0	29	20.2
North Dakota	.5	9.0	.1	120	*	141	2.8	62	31.0
South Dakota	.5	21.2	.3	315	.1	112	5.3	66	10.1
Utah	.2	2.4	*	52	*	190	6.0	22	40.0
Wyoming	.2	7.1	.1	162	.1	77	21.0	52	40.0
Total	3.5	173.8	2.1	3,109	1.2	104	6.3	65	17.7
PACIFIC COAST									
Alaska	.1	--	--	--	--	--	--	--	--
California	.5	96.1	1.2	1,344	.5	95	20.2	89	19.9
Hawaii	.3	2.5	*	20	*	167	20.0	--	--
Oregon	.5	54.6	.7	1,105	.4	72	8.9	53	13.3
Washington	.5	79.6	1.0	1,594	.6	76	12.8	45	15.4
Total	1.9	232.8	2.8	4,063	1.6	82	12.9	63	15.9
TOTAL UNITED STATES		8,265.8		257,033		52	15.3	29	17.9

Note: State values have been rounded and therefore may not add to totals.

* Less than 0.5%.

[1]Federal cost shares include $125,531 for fencing, fire protection roads, fire protection ponds, and other miscellaneous practices, i.e., 1.5 percent of total federal spending.
[2]Includes acres treated for all practices except those listed in footnote 1.
[3]Tree planting includes planting bare land, planting after major and minor site preparation, and site preparation for natural regeneration, i.e., RE-3 plus site preparation for natural regeneration.
[4]Intermediate treatments include precommercial thinning, understory release, cull tree removal, and pruning, i.e., RE-4 minus site preparation for natural regeneration.
[5]Private plus federal direct treatment cost.

Acres Treated, by Practices and Forest Type

Site preparation and/or planting constituted the primary practice funded in the South (81 percent of the acres treated, see table 4). This practice includes bare land planting, site preparation and planting, and site preparation for natural regeneration. The next largest practice was precommercial thinning and release (14 percent); the balance was cull tree removal and pruning (5 percent). Loblolly-shortleaf pine was the most frequently treated forest type in the South (70 percent). Longleaf-slash pine was next (24 percent) with some white-red-jack pine type (2 percent) in the mountains.

Site preparation and/or planting was also the most popular practice in the Lake States (56 percent of the acres treated). It was done mostly in the white-red-jack pine type, with a small amount of spruce-fir. The remaining acres treated in the Lake States were about evenly split between precommercial thinning and release, and cull tree removal and pruning. The maple-beech-birch type dominated the intermediate treatments.

In the Central region, the intermediate treatments were applied to more acres, mostly in the oak-hickory type, than site preparation and/or planting. Precommercial thinning and release were done on 42 percent of the acres treated, and cull tree removal and pruning on 37 percent. The remaining 22 percent was site preparation and/or planting.

In the Northeast, intermediate treatments also dominated, primarily in the maple-beech-birch type. Precommercial thinning and release composed the bulk of the program (66 percent), followed by cull removal and pruning (12 percent); site preparation and/or planting was applied on 22 percent of the acres treated.

In the West, precommercial thinning and release was also the largest component (54 percent), usually involving ponderosa pine. Most of the remaining acres treated in the West (43 percent) received site preparation and/or planting, mostly to Douglas-fir.

Overall, 73 percent of the FIP cost-share funds were spent on site preparation and/or planting on 61 percent of the program acreage. Similarly, 72 percent of the 1972 REAP forestry funds were spent on tree planting (USDA-ASCS 1973). A timber outlook study (USDA-FS 1973b) indicated that profitable opportunities for planting are much more extensive on nonindustrial private lands than timber stand improvement opportunities. In earlier years of REAP less emphasis was placed on tree planting (James and Schallau 1961).

Ownership Size

About 75 percent of the acres treated were on ownerships in excess of 100 acres (table 2). All the regions had a similar acreage distribution by ownership size.

Two strong patterns between ownership size and size of the tract treated are apparent in table 2. First, the average tract size increases as ownership size increases. For example, the average tract size nationwide is 11 acres for ownerships from 1 to 100 acres, in contrast to 27 acres for ownerships over 500 acres. This same positive relationship persists, although to different degrees, across all regions and practices. Numerous studies have concluded similarly that those who have larger ownerships are more likely to practice forestry and participate in assistance programs (Yoho and James 1958, Webster and Stoltenberg 1959, South et al. 1965, Anderson 1968a).

Second, average tract size for the same ownership size class varies among regions. For example, the average tract size in the South for 101- to 200-acre ownerships is 23 acres, but in the Northeast, treated tracts average only 9 acres for the same ownership size class. The smaller tract sizes in the Northeast persist even for individual practices. For example, the average bare land planting tract in the South for 101- to 200-acre ownerships is 18 acres, but the corresponding average tract size in the Northeast is only 6 acres. It appears, then, that ownership size is not a factor that limits FIP tract sizes in the North relative to the South.

Table 2.--Average tract size and percentage of acres treated, by region and ownership size class

Region	1 to 100 acres		101 to 200 acres		201 to 500 acres		501+ acres	
	Tract size	Acres treated	Tract size	Acres treated	Tract size	Acres treated	Tract size	Acres treated
	Acres	*%*	*Acres*	*%*	*Acres*	*%*	*Acres*	*%*
South	15.7	21	22.7	23	27.7	39	30.9	17
Central	9.0	21	12.4	23	18.0	33	30.4	23
Northeast	6.5	32	8.7	27	11.3	28	22.2	13
Lake States	6.9	38	8.0	28	8.5	24	9.5	10
Plains and Rockies	10.0	22	12.6	16	18.0	32	17.7	30
Pacific Coast	11.9	41	13.9	24	17.0	30	15.2	6
Total United States	10.5	24	15.1	24	20.8	36	26.9	17

Note: Totals may not equal 100 due to rounding.

Practice Application

Landowners were permitted to either install the practice themselves or hire a vendor or contractor. The proportion of jobs contracted varied significantly by region and practice, due perhaps to differences in the availability of vendor services and the size of the tracts being treated. For example, 80 percent of the tree planting jobs were done by vendors in the South, compared with 25 percent in the Lake States. For the total program, 59 percent of the planting and 38 percent of the nonplanting jobs were done by vendors.

Land Use Preceding Treatment

The majority of the acres treated (80 percent) were forest land before treatment (table 3). Except for the Lake States, where more pasture and cropland were treated, the regions generally followed the same pattern of preceding land use.

These data do not directly estimate the net program impact on land use because, for example, some of the cropland may have reverted to forest. The data indicate, however, that FIP probably has little impact on land use conversions. Future shifts of FIP acres out of forest land use will probably be more prevalent than conversion of good cropland to forest under FIP.

COST EFFECTIVENESS OF MAJOR PROGRAM COMPONENTS

The four indicators of the cost effectiveness of 1974 FIP include the practice and forest type to which it was applied, tract size, cost per acre, and site class. These same indicators are used in management guides to determine the most profitable investments (Anderson and Guttenberg 1971), and are basic to the cost-effective timber production.

For convenience, each indicator is presented separately. It is the combination of characteristics for each tract that actually controls financial return, however. For example, higher costs may be more acceptable on good sites than on poor sites. The distribution of acres treated by tract size, per-acre cost, and site class are presented later in combination to give a clearer picture of total cost effectiveness.

Type of Practice

Considerable research and practical experience have been amassed on the silvicultural and financial-return characteristics of forestry practices applied to various forest types. Results of these past studies suggest that the vast majority of the acres treated in 1974 FIP should yield good returns—if correctly installed in the proper situations and if harvested when mature. The composition and expected cost effectiveness were:

Practice and forest type	Percent of acres treated	Expected cost-effectiveness
Site preparation and/or planting, southern pine	49	good
Precommercial thinning and release, southern pine	8	good
Cull tree removal, southern pine and oak-pine	4	poor
Precommercial thinning and release, oak-pine	2	poor
Site preparation and/or planting, red-white-jack pine and spruce-fir	8	fair
Precommercial thin, release, and cull removal, maple-beech-birch	7	fair
Precommercial thin and release, oak-hickory	6	poor
Cull tree removal, oak-hickory	5	poor
Site preparation and/or planting, hardwoods	1	good
All practices, Douglas-fir and ponderosa pine	3	mixed
Miscellaneous practice and types	8	mixed

Table 3.--Land use, by region,[1] before treatment under Forestry Incentives Program

Region	Forest		Cropland		Pasture		Other		Total
	Acres	*%*	*Acres*	*%*	*Acres*	*%*	*Acres*	*%*	*Acres*
South	130,547	82	9,131	6	13,435	8	5,737	4	158,850
Central	35,818	80	1,178	3	4,676	10	2,897	7	44,569
Northeast	23,793	83	1,619	6	2,004	7	1,085	4	28,501
Lake States	9,938	55	2,442	14	3,166	18	2,395	13	17,941
West	6,220	87	57	1	628	9	267	4	7,172
Total United States	206,316	80	14,427	6	23,909	9	12,381	5	257,033

[1]Regions include the same States as shown in table 1 except West includes both the Rocky Mountains and the Pacific Coast.

Anderson and Guttenberg (1971), Row (1974), and Knight and McClure (1974) all showed good returns for site preparation and/or planting southern pine. Given possible problems with initial practice follow-up, however, the practice should be restricted to sites where hardwood competition is not severe (Anderson 1975).

Gutterberg (1970), Balmer and Williston (1973), Mann and Lohrey (1974), and Knight and McClure (1974) all concluded that precommercial thinning and release of southern pine shows good returns under certain conditions. Pine stands less than 4 years old and very densely stocked (according to Balmer and Williston (1973) 1,500 stems per acre) can benefit from precommercial thinning down to 500 to 700 stems per acre. If thinning is delayed, treatment cost increases and the growth response declines.

A Georgia case study by Anderson (1968b) showed high returns from cull removal in pole- and sawtimber-sized loblolly-shortleaf stands. Lewis and Chappelle (1964), however, rejected such investments in pine stands in Virginia as unprofitable. Profitability is greatly influenced by residual pine stocking, stand age, and market value of the hardwood removed. The practice should be applied selectively. Similar qualifications are required for precommercial thinning and release of oak-pine stands.

Analyses of red pine and white pine plantations showed fair returns (Manthy et al. n.d., Lundgren 1966, Wallace and Hopkins 1968, Manthy 1970). Manthy (1970) and Nadeau (1970) also concluded that planting spruce had the potential for fair returns.

Studies by Worley and Wheeland (1968), Manthy (1970), and the USDA-FS (1973b) all showed fair returns for precommercial thinning, release, and cull tree removal in maple-beech-birch. However, proper application of intermediate hardwood treatments is sometimes difficult. For example, McCauley and Marquis (1972) found in a northern hardwood precommercial thinning case study that light crop-tree release returned 10 percent on investment while a heavy crop-tree release showed a negative return. The heavy release did not stimulate a large enough increase in growth to compensate for the added cost.

Herrick and Morse (1968), Manthy (1970), Callahan and Wenger (1973), and Gansner and Herrick (1973) all produced evidence that returns from intermediate treatments in oak-hickory are relatively poor, unless treatment is restricted to good sites, and to stands with proper stocking that have enough time to respond to treatment before final harvest. Cull tree removal in oak-hickory similarly yields poor returns. The returns from some oak-hickory treatments may be higher if a black walnut stand component is the object of the treatment.

While the less desirable oak-hickory practices do not make up a large component of the total program, they are concentrated in a relatively few States:

	Percent of oak-hickory acres in U.S. given intermediate treatments		Percent of total acres treated in the State
Illinois	7		79
Indiana	12		78
Kentucky	3		25
Missouri	33		57
Ohio	6		20
Pennsylvania	5		25
Tennessee	8		51
West Virginia	7		47
Total	81	Average	48

Analyses such as those by Dutrow et al. (1970) on cottonwood and by Callahan and Smith (1974) on black walnut indicate that hardwood planting can generate good returns. The site requirements are quite specific, however, and planting must be followed by a rather intensive regime of subsequent treatments.

Site preparation and/or planting, precommercial thinning, and release of Douglas-fir and ponderosa pine were applied on 2 percent of the area treated. Analysis has shown that many such investments are profitable (Beuter and Handy 1974).

Several practices and forest type combinations made up the remaining 8 percent of the total area treated. Some intermediate treatments in the elm-ash-cottonwood type, for example, will no doubt be profitable investments.

Less than 1.5 percent of the Federal funds were expended on fire roads, firebreaks, fire ponds, and "other" categories not covered under the practices already mentioned.

Therefore, except for the relatively small oak-hickory component, the majority of the treatments were applied in practice-forest type combinations which are financially acceptable. This conclusion must be qualified, of course, by the assumption that the practice was properly installed on the correct site, that the tract will receive the necessary intermediate treatments, and that it will be harvested when mature.

Tract Size

Tract size, the second indicator of cost effectiveness, has a major impact upon the per-acre cost through the allocation of fixed costs. The costs of moving men and equipment to the tract are the same regardless of tract size, as are the Federal and State overhead costs. Previous assistance programs have been criticized for their preponderance of small tracts, with the resulting diseconomy of small scale production.

Impact of Tract Size on Financial Return

The diseconomy of small-scale production affects both practice application and final harvesting. Diseconomies are especially great with capital-intensive operations, such as site preparation and machine planting.

Row (1973) developed per-acre cost estimates by tract size for various practices by fitting regression equations to costs of National Forest silvicultural contracts. The following per-acre costs were estimated for southern pine:

	Tract size (acres)			
	10	40	80	160
	(*Dollars/acre*)			
Site preparation and planting	107	59	48	43
Precommercial thinning	52	17	12	9
Cull-tree removal	26	14	12	11

Note the significantly higher costs on the smallest tracts.

Wikstrom and Alley (1967) compiled per-acre treatment costs for silvicultural treatments by tract size on National Forests in the northern Rocky Mountains and derived similar results. The per-acre cost for hand planting was $83 for 1- to 10-acre tracts, but dropped to $21 for 21- to 30-acre tracts. Conkin (1971) also found that small tract size increased per-acre treatment costs in the North.

A significant percentage of the acres in 1974 FIP, especially in the north, were treated by the owners themselves. If tract size only had an impact during treatment application, and if the owner was willing to apply the practice himself, small tracts would not endanger FIP's goal. Unfortunately, diseconomies of small scale are also reflected at harvest time in the lower stumpage price the sale can command due to higher harvesting cost per unit volume (Anderson 1969, Row 1974).

Row[2] estimated the net impact of tract size on financial return of loblolly pine plantations. The rate of return by tract size for site index 80 stands, where site preparation, planting, and hardwood control were followed by commercial thinning, was:

Tract size (*Acres*)	Internal rate of return (*Percent*)
10	3.1
20	4.7
40	6.2
80	7.0
160	7.5
320	7.8

These estimates suggest that it is possible to double the rate of return on loblolly pine plantations by simply managing 40-acre instead of 10-acre tracts. Most of the economy of scale is captured by managing 50-acre tracts, and 15 to 50 acres appears to be the transition phase.

More disturbing than the higher average cost of harvesting small tracts is the possibility that small tracts will not be harvested at all because of prohibitive costs. Herrick (1975), for example, surveyed loggers in the Northeast concerning their most recent logging chance. Even with the relatively fragmented ownership in the Northeast, in only 3 percent of the cases was the most recently harvested tract less than 10 acres. Fifty percent of the most recent harvests were over 100 acres. The median size for predominantly pulpwood operations was 132 acres.

In a recent forest survey of North Carolina, an estimated 14 percent of the harvested area was in 1- to 5-acre tracts.[3] Seventy-eight percent of the area harvested was in tract sizes larger than 10 acres. If the current trend toward capital-intensive harvesting systems continues, the problem of harvesting small tracts will be even greater in the future.

There may be instances where a few high-quality hardwood trees can be profitably treated on very small tracts, or where the treated area can be combined with similar adjacent acreage held by the same owner to yield a profitable return. A limited number of small tracts may even be justified as an educational outlay to generate program interest. In general, however, tract sizes from 1 to 10 acres, particularly those involving site preparation and planting, are not financially attractive investments, and probably carry a higher risk of abandonment.

Zivnuska (1974) and the President's Advisory Panel on Timber and the Environment (1973) both suggest that holdings of less than 200 acres are generally too small to justify intensive management. While some situations probably exist where that much acreage is required, the evidence cited above does not generally support a minimum as large as 200 acres.

Tract Size Distribution

The overall tract size performance in 1974 was favorable. Only 26 percent of the acres treated were in 1- to 15-acre tracts, 47 percent were in 16- to 50-acre tracts, and 27 percent were in tracts larger than 50 acres (table 4, fig. 1).

The South had the most favorable distribution. Only 16 percent of the area treated was in 1- to 15-acre tracts while 30 percent was in tracts 51+ acres in size. The average tract size in the South was 23

[2] *Personal communication with Clark Row, Division of Forest Economics and Marketing Research, USDA Forest Service, Wash. D.C.*

[3] *Personal communication with the Forest Resources Research Project, Southeastern Forest Experiment Station, USDA Forest Service, Asheville, North Carolina.*

Table 4.--Acreage and percentage of acreage by region,[1] practice,[2] and tract size[3]

Region and practice	Tract size: 1- to 15 acres		16- to 50 acres		51+ acres		Total acreage[4]		Average tract size	U. S. total[5]	Predominant forest type after treatment[6]
	Acres	*%*	*Acres*	*%*	*Acres*	*%*	*Acres*	*%*	*Acres*	*%*	
SOUTH											
Site preparation and/or planting	22,078	17	74,538	58	31,332	24	127,948	81	21.5	50	Loblolly-shortleaf and longleaf-slash pine
Precommercial thinning and release	1,934	9	8,313	37	12,210	54	22,457	14	34.7	9	Loblolly-shortleaf pine
Cull removal and pruning	678	8	3,414	40	4,353	52	8,445	5	35.9	3	Loblolly-shortleaf pine
Total	24,690	16	86,265	54	47,895	30	158,850		23.3	62	
CENTRAL											
Site preparation and/or planting	5,224	54	2,821	29	1,593	17	9,638	22	6.8	4	Loblolly-shortleaf and white-red-jack pine
Precommercial thinning and release	3,900	21	7,372	40	7,342	39	18,614	42	22.2	7	Oak-hickory
Cull removal and pruning	3,559	22	6,572	40	6,186	38	16,317	37	21.2	6	Oak-hickory
Total	12,683	28	16,765	38	15,121	34	44,569		14.7	17	
NORTHEAST											
Site preparation and/or planting	3,681	58	1,404	22	1,258	20	6,343	22	6.5	2	White-red-jack pine
Precommercial thinning and release	10,317	55	6,931	37	1,488	8	18,736	66	10.5	7	Maple-beech-birch
Cull removal and pruning	2,090	61	968	28	364	11	3,422	12	8.7	1	Maple-beech-birch
Total	16,088	56	9,303	33	3,110	11	28,501		9.0	11	
LAKE STATES											
Site preparation and/or planting	6,649	66	2,977	30	424	4	10,050	56	6.1	4	White-red-jack pine
Precommercial thinning and release	2,128	48	1,882	43	409	9	4,419	25	11.8	2	Maple-beech-birch
Cull removal and pruning	1,589	46	1,440	41	443	13	3,472	19	11.3	1	Maple-beech-birch and white-red-jack pine
Total	10,366	58	6,299	35	1,276	7	17,941		7.7	7	
WEST											
Site preparation and/or planting	1,375	45	1,302	42	397	13	3,074	43	11.3	1	Douglas-fir
Precommercial thinning and release	1,111	29	1,849	48	892	23	3,852	54	16.7	1	Ponderosa pine and Douglas-fir
Cull removal and pruning	12	5	178	72	56	23	246	3	24.6	*	Ponderosa pine
Total	2,498	35	3,329	46	1,345	19	7,172		14.0	3	
TOTAL UNITED STATES											
Site preparation and/or planting	39,007	25	83,042	53	35,004	22	157,053	61	15.3	61	
Precommercial thinning and release	19,390	28	26,347	39	22,341	33	68,078	26	17.6	26	
Cull removal and pruning	7,928	25	12,572	39	11,402	36	31,902	12	18.6	12	
Total	66,325	26	121,961	47	68,747	27	257,033		16.2		

Note: Totals may not check due to rounding error.

* Less than 0.5%.

[1]Regions include the same States as shown in table 1 except West includes both the Rocky Mountains and the Pacific Coast.
[2]Site preparation and/or planting includes RE-3 (plant bare land and planting after site preparation), and one practice from RE-4 (site preparation for natural regeneration); other practices are components of RE-4.
[3]Percentages indicate percentage of acres treated in that region and practice category that occur in that parcel class, for example, 15 percent of the acres treated with site preparation and/or planting in the South were in 1- to 15-acre parcels.
[4]Percentages indicate percentage of acres treated in that region that occur in that parcel class, for example, 15 percent of the acres treated in the South received a site preparation and/or planting treatment.
[5]Percentages indicate percentage of acres in the entire United States treated in that region and practice group.
[6]Where more than one type is shown, first listed is most prevalent.

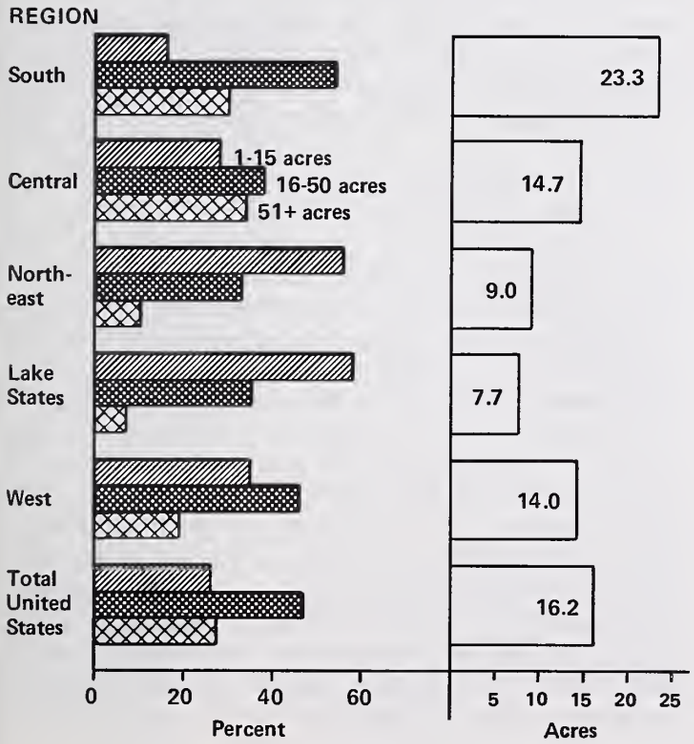


Figure 1.—Percentage of acres treated by tract size class and average tract size.

acres. In the Central region, a much larger portion (28 percent) was in the 1- to 15-acre tract size.

The Northeast and Lake States regions had the poorest tract size distribution; over half of the acres treated were in the 1- to 15-acre class and 20 percent in the 1- to 5-acre class. The average tract size for site preparation and/or planting practices in the two regions was 6 acres, lower than any other regions.

Tract size distribution in the West was fair. Thirty-five percent of the area was in 1- to 15-acre tracts, and 19 percent was in 51-acre or larger tracts. The tract size average for the West was 14 acres.

Because of the favorable tract sizes in the South and Central regions, the overall size distribution is fair with an average tract size of 16.2 acres. Small tracts are still a problem, however. For example, 7 percent or 17,495 acres of the program were in 1- to 5-acre tracts, and 3 percent in 1- to 3-acre tracts. If these acres were treated at the average per-acre cost for the program, $227,000 in Federal cost shares was spent on 1- to 3-acre tracts in 1 year.

In those States with over 2,000 acres in site preparation and/or planting or in intermediate treatments, tract size distribution varied widely:

Largest tract size:	*Acres*
Site preparation and/or planting—	
Georgia	30.5
South Carolina	25.6
Louisiana	25.0
Intermediate treatments—	
Georgia	62.8
Oklahoma	57.8
Texas	45.6
Smallest tract size:	
Site preparation and/or planting—	
Minnesota	3.7
Pennsylvania	4.4
Wisconsin	6.4
Intermediate treatments—	
Maine	8.1
New York	9.4
Pennsylvania	11.2

In those States with the largest average tract size, there were also few small tracts. Only 1 percent of the acres treated were on 1- to 5-acre tracts compared with 7 percent for the total program; 41 percent were in tracts larger than 50 acres.

In the States with the smallest average tract size, the tract sizes for intermediate treatments are generally large enough so that economy of scale problems are not prominent. The generally low capital intensity of many intermediate treatments reduces the problems of small tracts, at least at the time the initial practice is applied. Intermediate treatments were applied on 6,600 acres of 1- to 5-acre tracts—only 2.6 percent of the entire program.

There is a problem with small plantations, however; 37 percent of the site preparation and/or planting in the three low-average States was on 1- to 5-acre tracts, and only 2 percent was on tracts over 50 acres. In 21 States, 10 percent or more of the acres treated were in 1- to 5-acre tracts (table 5). In one northern State, 44 percent of all the acres treated were in 1- to 5-acre tracts, and 20 percent were in 1- and 2-acre tracts. Most of these small tracts involved tree planting.

It is tempting to conclude that ownership size restricted tract size in the North for 1974 FIP, but ownership data on FIP participants (table 2) does not support this contention. Even in the Lake States, where 58 percent of the acres treated were in tracts of 15 acres or less, over 60 percent of the acres treated were on ownerships larger than 100 acres.

Physiographic differences may partially neutralize the large ownerships in the North, where moisture and soil conditions may change markedly over a short distance. This often divides the lands into forest management units smaller than the ownership. In the South, where the pine and oak-pine lands of the Coastal Plain and Piedmont extend for miles, ownership size is probably more often the restricting factor.

Comparison With Tract Sizes of Other Programs

The average 1974 FIP tract size compares favorably with that of 1972 REAP. The average tract size for site preparation and/or planting in 1974 FIP was 15.3 acres (table 1), while the average for 1972 REAP tree planting was only 6.7 acres (USDA-ASCS 1973). The major reason for the larger average FIP size is that more of the FIP money went to the South, which consistently had larger tree-planting tract sizes under REAP than the rest of the Nation. The 1974 FIP average tract size in the South was about equal to the South's previous REAP average, however. The average FIP tract size for intermediate treatments, 17.9 acres, was slightly below that achieved in 1972 REAP timber stand improvement, 20.7 acres.

FIP's 1974 tract sizes do not compare as well against National Forest tract sizes. The average tract size on National Forest silvicultural service contracts in 1970 was 70 acres for thinning, 46 acres for site preparation, and 48 acres for hand planting (Row 1973). Stand sizes in the Southern Region (Region 8) are administratively determined. Softwood stands there vary from 10 to 100 acres, while hardwood stands vary from 10 to 50 acres. In the Eastern Region (Region 9), a sampling of National Forest stand sizes showed an average of 40 acres in Wisconsin, 51 in Vermont, 20 in Missouri, and 35 in Indiana. Although there is evidence that increasing concern for nontimber values on the National Forests may reduce the average stand size (for example, Wyoming Forest Study Team 1971), the National

Table 5.--States and regions where 10 percent or more of the acres treated were in 1- 5-acre tracts, and the percentage of total United States funds spent for treating all tract sizes

States and regions	Percentage of acres treated, by tract size						Percentage of total U.S. funds spent
	1- to 5-acre tracts	1 acre	2 acres	3 acres	4 acres	5 acres	
	%	%	%	%	%	%	%
STATE							
Connecticut	28	1	7	3	1	15	0.4
Illinois	10	*	*	2	3	5	1.0
Iowa	34	7	9	7	7	5	.3
Kansas	13	2	1	2	3	5	.6
Kentucky	11	2	3	3	2	3	1.5
Maine	23	2	3	3	4	11	1.5
Massachusetts	13	*	*	1	*	11	.9
Michigan	13	1	2	3	2	5	2.8
Minnesota	44	10	10	8	6	11	.9
Montana	10	0	2	1	1	7	.4
Nebraska	10	1	2	3	3	2	1.0
New Hampshire	18	1	2	3	2	10	1.6
New Jersey	25	2	3	3	2	14	.4
New York	24	*	*	*	*	23	1.9
North Dakota	40	6	7	10	13	4	.1
Oregon	15	*	2	4	3	6	.7
Pennsylvania	25	2	6	6	4	7	2.3
Rhode Island	42	0	0	8	0	34	*
South Dakota	17	3	6	2	1	5	.3
West Virginia	30	5	8	5	4	8	1.4
Wisconsin	24	2	4	5	4	9	1.7
REGION							
South	3	*	*	1	1	1	66.0
Central	8	1	1	1	1	2	13.7
Northeast	20	1	2	3	2	12	10.0
Lake States	20	2	4	4	3	7	5.4
Plains and Rockies	8	1	2	1	1	3	2.1
Pacific Coast	7	*	1	2	1	3	2.8
TOTAL UNITED STATES	7	1	1	1	1	3	100.0

Note: Totals may not check due to rounding error.

* Less than 0.5%.

Forest average tract size will probably still exceed that of 1974 FIP.

In conclusion, the tract size distribution of 1974 FIP is generally good, both in relation to available evidence on economies of scale and to the performance of similar programs. The small tracts that are treated under FIP are still a problem, however.

Per-Acre Treatment Costs

Treatment costs have a direct influence on financial returns, especially with costly initial practices and long rotations where a large interest charge accumulates. Total costs, private plus Federal share, represent the entire direct investment cost and permit comparison with industry and Forest Service costs. Technical assistance and administrative overhead costs are not included, however.

Total cost was calculated by dividing the Federal cost per acre by the percentage of Federal cost-share rates. This procedure may not always yield accurate individual total direct cost estimates; however, if the Federal cost share is properly determined at the State and County levels, the average total cost for a group of tracts should be accurate.

Total per-acre cost is used directly as an indicator of performance because, if other factors are equal, lower costs result in greater cost effectiveness and higher financial returns. The variation of treatment costs within and among States was also analyzed, and FIP costs were compared with costs experienced by others.

Per-Acre Costs of 1974 FIP

The average total cost for site preparation and/or planting in 1974 was $52 per acre (see table 1). The average cost in the Northeast and Lake States ($41) was below the national average, the Pacific Coast cost ($82) was above the national average, and the Plains and Rocky Mountain average ($104) was considerably above the national average.

The national average for intermediate treatments was $29 per acre. The averages for the South, Central, and Lake States regions were equally low, while costs in the Plains and Rockies and the Pacific Coast were twice the national average.

Costs on most acres treated in 1974 ranged between $21 and $50 per acre (table 6, fig. 2). Some regional differences in cost patterns are only partially reflected in the average costs, however. For example, a much smaller proportion of the acres treated in the Northeast cost less than $20 per acre than in adjacent regions.

While the average costs for 1974 FIP are generally favorable, over 8,000 acres were treated at a total cost that exceeded $100 per acre. Most of this higher cost component (89 percent) involved site preparation and planting, and occurred primarily in the South (62 percent). Most of the balance was in the West (21 percent).

As with small tract size, not all of these high-cost site preparation and planting cases should be bypassed as unprofitable. Anderson and Guttenberg (1971), for example, estimated that a $100-per-acre investment in slash pine plantations on medium sites would yield above 4 percent return. Plantations that cost only $50 per acre would yield about 6.5 percent return, however, and twice as many acres could be treated.

Figure 2.—Percentage of acres treated by total direct cost classes and average cost.

Variation of Per-Acre Costs Among and Within States

Some States had higher average costs than others, just as some had larger average tract sizes than others. Restricting the comparison again to States that treated more than 2,000 acres, average costs were:

Highest costs per acre:	
Site preparation and/or planting—	
North Carolina	$79
South Carolina	68
Texas	56
Intermediate treatments—	
Pennsylvania	48
Ohio	47
New Hampshire	41
Lowest costs per acre:	
Site preparation and/or planting —	
Michigan	33
Arkansas	36
Louisiana	37
Intermediate treatments—	
Georgia	19
Mississippi	19
Missouri	19
Oklahoma	18

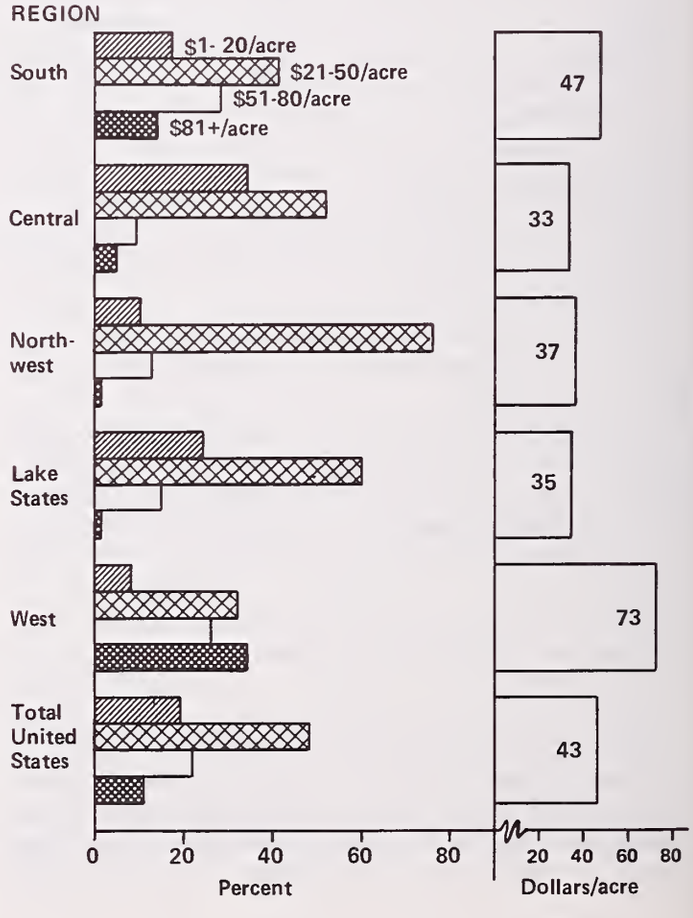


Table 6.--Percentage of treated acres in four cost-per-acre classes, by region[1] and practice[2]

Region and practice	Cost/acre class				Average cost/acre
	$1-20	$21-50	$51-80	$81+	
	%	%	%	%	
SOUTH					
Site preparation and/or planting	12	36	34	18	$53
Precommercial thinning and release	37	63	1	0	23
Cull removal and pruning	41	58	1	-	23
Total	17	41	28	14	47
CENTRAL					
Site preparation and/or planting	18	44	24	15	52
Precommercial thinning and release	36	55	6	3	29
Cull removal and pruning	41	53	5	1	26
Total	34	52	9	5	33
NORTHEAST					
Site preparation and/or planting	18	55	25	2	41
Precommercial thinning and release	6	84	10	1	36
Cull removal and pruning	15	75	9	1	32
Total	10	76	13	1	37
LAKE STATES					
Site preparation and/or planting	10	64	25	2	41
Precommercial thinning and release	42	55	3	0	24
Cull removal and pruning	40	57	1	2	28
Total	24	60	15	1	35
WEST					
Site preparation and/or planting	4	24	27	45	85
Precommercial thinning and release	13	39	23	26	64
Cull removal and pruning	-	24	47	29	68
Total	8	32	26	34	73
TOTAL UNITED STATES					
Site preparation and/or planting	12	39	32	16	52
Precommercial thinning and release	27	64	6	3	31
Cull removal and pruning	38	57	4	1	26
Total	19	48	22	11	43

[1]Regions include the same States as shown in table 1 except West includes both the Rocky Mountains and the Pacific Coast.
[2]Site preparation and/or planting includes RE-3 (plant bare land and planting after site preparation), and one practice from RE-4 (site preparation for natural regeneration); other practices are components of RE-4.

The average total cost of site preparation and/or planting in the more costly States was about twice as much as in the least costly States. Note that North Carolina, which spent 20 percent of the Federal cost-share funds in 1974 and much more than its original apportionment, had site preparation and/or planting costs roughly 50 percent higher than the average in the South. Although Virginia was not one of the States with lowest costs, it only spent 40 percent of its original apportionment; its average total cost for site preparation and/or planting was 30 percent below the Southern average.

Per-acre treatment costs varied among adjacent States for the same practice:

	Treatment costs per acre	
	Plant bare land	Site preparation and planting
Southeast:		
Virginia	$21.54	$42.79
North Carolina	35.37	82.98
South Carolina	22.38	83.37
Georgia	23.77	45.86
Lake States:		
Michigan	33.73	30.41
Wisconsin	44.81	45.54
Minnesota	52.04	63.08

Moak and Kucera (1975) found that treatment costs were higher in the northern Coastal Plain of the South than in the southern Coastal Plain, but not enough to explain the above cost differences. South Carolina and North Carolina spent almost twice as much per acre on site preparation and planting as did Virginia and Georgia. Similarly, Minnesota spent more than Wisconsin, which in turn spent more than Michigan, despite the fact that the same species were planted throughout the region.

Per-acre treatment costs also varied considerably within the States. The dispersion of per-acre treatment costs within a State (index of variability) was measured by determining the dollar cost span required to encompass 80 percent of the acres treated with one practice. In 24 of the States where more than 100 acres received site preparation and planting, the cost span necessary to encompass 80 percent of the acres treated exceeded $50 per acre. In one western State a cost span of $100 per acre—from $35 to $135—was necessary to encompass 80 percent of the acres receiving site preparation and planting.

If the only impact of this cost variation were upon the equity among participants or an occasional overpayment for a tract, the issue would become an auditing question rather than one of program evaluation. Cost variation within a State is positively correlated with the average treatment cost in that State, however. The simple correlation between total cost and the index of cost variation was calculated for the South, North, West, and total United States for four narrow practice groups. For the North and South, a positive correlation significant at the 90 percent level or higher was found in six of the eight tests made. The positive correlation was significant at the 99 percent level for all four practice groups when the regions were combined.

It is uncertain what causes this variation. Costs do vary from one part of a State to another because of labor cost and terrain differences, but it is doubtful that such factors can explain this much variation. Differences in the method of estimating ceiling per-acre costs may partially explain the variations.

Comparison of Costs With Other Programs

The average per-acre costs in 1974 FIP are of the same general magnitude as costs experienced by others. Planned spending by Weyerhaeuser on its lands in 1974[4] provides one basis for comparison. The planned cost for site preparation and planting, derived by dividing total planned spending by total acres, was $80 per acre—slightly less than the site preparation and planting cost for FIP in the Pacific Coast ($88 per acre). Weyerhaeuser's planned pre-commercial thinning cost was $38 per acre, considerably less than FIP cost of $62 per acre.

Moak and Kucera (1975) compiled 1974 estimates of treatment cost from 101 questionnaires returned by individuals, private firms, and public agencies in the South. Their costs averaged about the same as costs for similar practices in 1974 FIP. West Gulf Coastal Plain treatment cost estimates collected by Sunda and Lowry (1975) are slightly lower than 1974 FIP costs.

Row[5] compiled data on the cost of Forest Service silvicultural service contracts let in 1970. Although the costs are not strictly comparable, when the 1970 contract costs are inflated by the wholesale price index up to 1974, the Southern costs are similar to FIP costs.

The average costs for 1972 REAP forestry practices provide yet another basis for comparison. When the 1972 REAP costs are inflated by the wholesale price index to 1974, they are generally the same as the 1974 FIP costs (table 7). Moak and Kucera (1975) found, however, that the cost of forestry practices in the South increased more than the wholesale price index. Therefore, FIP costs might actually compare more favorably with REAP costs than table 7 indicates.

In conclusion, the general per-acre cost performance of 1974 FIP is favorable, both in relation to acceptable financial returns and the costs performance of similar programs. There is a high-cost component, however, and some substantial cost variations that are difficult to explain.

[4] *From correspondence between Weyerhaeuser and the USDA Forest Service, August 1, 1974.*

[5] *Row, Clark. 1971. Silvicultural service contract cost study FY 1970. Office report, Forest Economics & Marketing Research, USDA Forest Service, Wash. D.C., 15 p.*

Table 7.--Total per-acre costs[1] for REAP and FIP, by region[2] and practice

Region	Tree planting		Intermediate treatments	
	REAP[3]	FIP[4]	REAP[5]	FIP[6]
South	$ 35	$ 53	$11	$23
Central	74	52	25	27
Northeast	53	41	37	36
Lake States	51	41	25	26
Plains and Rockies	118	104	35	65
Pacific Coast	55	82	38	63
Total United States	50	52	21	29

[1]1972 REAP costs were inflated at the wholesale Price Index up to 1974 for comparability.
[2]Regions include the same States shown in table 1.
[3]Includes the REAP A-7 practice.
[4]Tree planting includes planting bare land, planting after major and minor site preparation, and site preparation for natural regeneration, i.e., RE-3 plus site preparation for natural regeneration.
[5]Includes the REAP B-10 practice.
[6]Intermediate treatments include precommercial thinning, understory release, cull tree removal, and pruning, i.e., RE-4 minus site preparation for natural regeneration.

Site Productivity

The site quality, or inherent ability of the site to produce timber, has a major impact upon timber yield and therefore upon cost effectiveness of the program.

Impact of Site Class on Financial Return

Numerous timber investment case studies provide estimates of return on different site classes. Anderson and Guttenberg (1971) estimated that the rate of return from unthinned loblolly pine plantations was roughly 11 percent on good sites and 9 percent on medium sites. Row (1974) estimated similar impacts of site class upon returns in natural southern pine stands. Lundgren (1966) estimated that the return for red pine plantings on site index 60 land was 4.8 percent, but that the return for site index 45 land dropped to 3.3 percent. Manthy's (1970) estimate for red pine plantings showed a similar impact of site quality on returns. Herrick and Morse (1968) showed that site quality has a greater impact on returns from thinning and cull tree removal in upland hardwoods than in the conifer plantation cases cited. In those upland hardwood cases, the return was 6.8 percent on site index 60 tracts and zero on site index 40 tracts.

The site class of each tract, measured in potential cubic feet of growth per acre per year, was estimated by the service forester who handled the case. While the local forester may be the most qualified to make the site estimate, it is still a difficult judgment, especially for nonstocked areas or areas that will be converted to a species not currently growing there. For example, MacLean and Bolsinger (1973, 1974) found that the site class of nonstocked land in certain regions of California is frequently overestimated. They found it necessary to develop a regression equation based upon physical factors and indicator plants to gain a more accurate site class estimate. Because of these difficulties, the FIP site class estimates may not be as accurate as estimates of other parameters on FIP tracts.

Productivity of Sites Treated in 1974 FIP

The South generally treated better sites than other regions (table 8, fig. 3). Only 15 percent of the acres treated were in the 50- to 85-cubic-foot site class, compared with an average of 39 percent for other Eastern regions. The majority of the acres treated in the South (69 percent) and the total program (59 percent) were classed as 85- to 120-cubic-foot sites. A higher proportion of the acres treated in the West fell in the 120+ cubic-foot site class than in the South, mostly because of the excellent sites treated in Oregon. The West also had a higher proportion of acres treated in the 50- to 85-cubic-foot site class than the South.

The Central region treated the least productive sites. Almost half of the acres treated fell in the 50- to 85-cubic-foot site class. The poor sites treated in the Central region may be a problem because much of the region's treatment acreage involved intermediate treatments in oak-hickory, which generally yield low returns when applied to poor sites.

States varied in the productivity of sites treated, just as they did in the other indicators of cost effectiveness. Examples of varying site productivity in the South are:

	Percent of acres treated, by site class (cubic feet)		
	120+	85-120	50-85
Better sites:			
South Carolina	37	57	6
Virginia	24	69	7
Mississippi	20	75	5
Poorer sites:			
Arkansas	16	55	29
Florida	15	57	28
Texas	6	68	26

Table 8.--Percentage of acres treated in various site classes, by region[1] and practice[2]

Region and practice	Site class (cubic feet)		
	120+	85-120	50-85
	%	%	%
SOUTH			
Site preparation and/or planting	15	72	13
Precommercial thinning and release	19	56	26
Cull removal and pruning	20	65	16
Total	16	69	15
CENTRAL			
Site preparation and/or planting	14	46	40
Precommercial thinning and release	13	34	53
Cull removal and pruning	11	40	49
Total	12	39	49
NORTHEAST			
Site preparation and/or planting	27	48	25
Precommercial thinning and release	25	43	32
Cull removal and pruning	28	45	28
Total	26	44	30
LAKE STATES			
Site preparation and/or planting	8	59	34
Precommercial thinning and release	24	42	34
Cull removal and pruning	14	27	58
Total	13	48	38
WEST			
Site preparation and/or planting	42	41	17
Precommercial thinning and release	26	31	43
Cull removal and pruning	0	17	83
Total	32	35	33
TOTAL UNITED STATES			
Site preparation and/or planting	16	68	16
Precommercial thinning and release	19	44	36
Cull removal and pruning	15	45	39
Total	17	59	25

[1]Regions include the same States as shown in table 1 except West includes both the Rocky Mountains and the Pacific Coast.

[2]Site preparation and/or planting includes RE-3 (plant bare land and planting after site preparation), and one practice from RE-4 (site preparation for natural regeneration); other practices are components of RE-4.

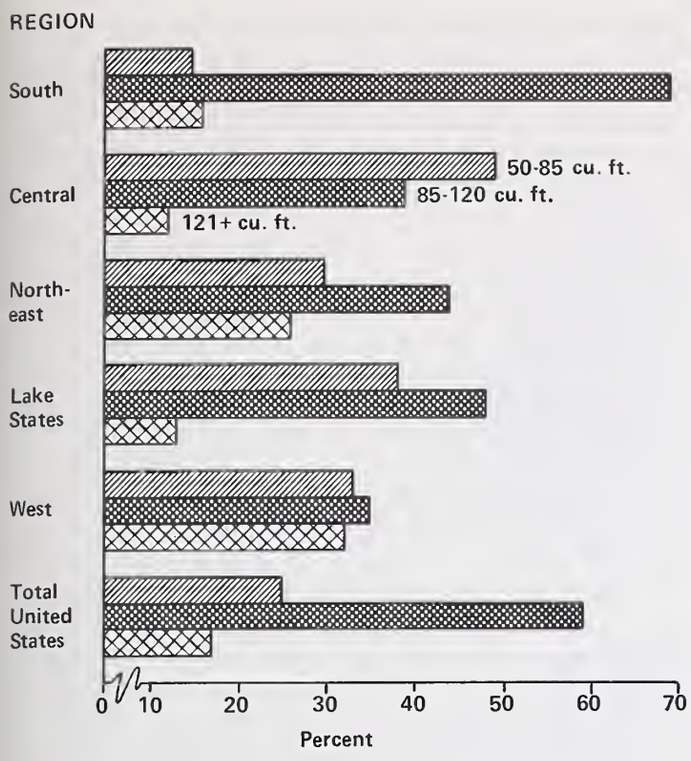


Figure 3.—Percentage of acres treated by site class.

Note that, while the percentage of acres treated in the 85- to 120-cubic-foot class is about the same for the two groups, the percentages in the higher and lower site classes are nearly reversed.

USDA Forest Service estimates of regional acreages of all nonindustrial private forest land in site classes above 50 cubic feet do not correspond closely with the site class distribution of FIP acres treated by region. For example, the South and Central regions have a similar distribution of nonindustrial private acreage among the 50+ cubic-foot classes:[6]

	Percent of total acres, by site class (cubic feet)		
	120+	85-120	50-85
South	8	34	59
Central	5	36	58

By contrast, the reported FIP site performance in the South is quite a bit better than in the Central region (see table 7). How much this difference is caused by actual differences in performance and how much results from data difficulties is uncertain.

[6] *Unpublished data from the files of the Resource Supply and Evaluation Techniques Unit, Rocky Mountain Forest and Range Experiment Station, USDA Forest Service, Fort Collins, Colorado.*

The only site class information available for other public assistance programs is that compiled by Westat (1972) for management plans prepared in selected States in 1967 under the Cooperative Forest Management (CFM) program. Although the site classes are divided into different ranges, the distribution is similar to or a little lower than that experienced in 1974 FIP:

Site class	Percent of area
140+ cubic feet	19
70 to 140 cubic feet	60
Less than 70 cubic feet	21

Program Performance as Reflected in Combined Cost-Effectiveness Indicators

Except for extreme cases, high costs alone are not certain indications of poor financial returns any more than low costs insure high returns. The interaction of a number of cost-effectiveness factors determines the eventual return. In table 9, the percentage of acres treated in each region are distributed by three site classes, three tract-size classes, and four total-cost classes. This makes it possible to see, for example, if the small tracts in the North are also associated with high costs or low sites, and if the low costs in the Central region are hampered by poor sites.

Table 9.--Percentage of acres treated in the respective regions by joint total cost-per-acre, site and tract size class

Region, site class, and tract size	Cost per acre/class			
	$1-20	$21-50	$51-80	$81+
	%	%	%	%
SOUTH				
120+ cubic feet				
51+ acres	1	3	1	*
16-50 acres	1	3	2	2
1-15 acres	*	1	*	*
85-120 cubic feet				
51+ acres	6	12	2	--
16-50 acres	4	11	14	8
1-15 acres	1	5	3	2
50-85 cubic feet				
51+ acres	1	2	1	*
16-50 acres	1	3	3	1
1-15 acres	*	1	1	*
NORTHEAST				
120+ cubic feet				
51+ acres	1	*	*	--
16-50 acres	*	8	2	*
1-15 acres	*	12	2	*
85-120 cubic feet				
51+ acres	--	2	*	--
16-50 acres	2	9	2	*
1-15 acres	1	22	5	*
50-85 cubic feet				
51+ acres	3	3	--	--
16-50 acres	1	8	*	--
1-15 acres	1	11	1	*
PLAINS AND ROCKIES				
120+ cubic feet				
51+ acres	4	2	--	--
16-50 acres	--	1	3	--
1-15 acres	--	1	*	1
85-120 cubic feet				
51+ acres	--	5	--	--
16-50 acres	1	--	3	4
1-15 acres	*	1	2	8
50-85 cubic feet				
51+ acres	5	7	4	--
16-50 acres	2	16	7	7
1-15 acres	*	3	4	9
TOTAL UNITED STATES				
120+ cubic feet				
51+ acres	2	2	1	*
16-50 acres	1	3	2	1
1-15 acres	*	3	1	1
85-120 cubic feet				
51+ acres	5	9	2	--
16-50 acres	3	10	10	6
1-15 acres	1	8	3	2
50-85 cubic feet				
51+ acres	3	3	1	*
16-50 acres	2	6	2	1
1-15 acres	1	4	1	*

Region, site class, and tract size	Cost per acre/class			
	$1-20	$21-50	$51-80	$81+
	%	%	%	%
CENTRAL				
120+ cubic feet				
51+ acres	2	2	--	--
16-50 acres	1	3	1	*
1-15 acres	*	2	1	*
85-120 cubic feet				
51+ acres	5	5	*	--
16-50 acres	2	8	2	2
1-15 acres	2	8	3	1
50-85 cubic feet				
51+ acres	12	8	--	--
16-50 acres	5	11	2	*
1-15 acres	3	5	2	*
LAKE STATES				
120+ cubic feet				
51+ acres	2	--	--	--
16-50 acres	2	3	*	--
1-15 acres	1	4	1	*
85-120 cubic feet				
51+ acres	2	*	1	--
16-50 acres	4	9	1	--
1-15 acres	5	17	9	1
50-85 cubic feet				
51+ acres	*	2	--	--
16-50 acres	4	11	1	*
1-15 acres	4	15	2	*
PACIFIC COAST				
120+ cubic feet				
51+ acres	--	2	1	--
16-50 acres	2	5	8	7
1-15 acres	1	4	8	9
85-120 cubic feet				
51+ acres	--	9	--	--
16-50 acres	3	4	8	7
1-15 acres	*	4	2	5
50-85 cubic feet				
51+ acres	--	--	--	--
16-50 acres	--	--	1	5
1-15 acres	--	--	*	4

Note: Because of rounding, percentages may not add to 100.

* Less than 0.5%.

[1]The regions contain the same States as shown in table 1. The boxes within the regional tables contain roughly 50 percent of the acres treated in that region, derived by enclosing the closest large cells.

It is apparent from this joint rating that a rather large proportion of the FIP investments have the potential to produce substantial timber yield increases and favorable financial returns. One measure of favorable program components is the percentage of the regional acreage on moderate to large tracts (16+ acres), on favorable sites (85+ cubic feet), treated at low to moderate cost (less than $50 per acre for total cost). Similarly, the acreage in the low site class (50 to 85 cubic feet), on medium to small tracts (less than 50 acres), that required moderate or high costs ($20+ per acre) can be tentatively identified as the least desirable component. Figure 4 shows the percentage of the acres treated in each region that fell into the "most" and "least" cost-effective components. The South rates high when the cost-effectiveness indicators are combined as well as when they are addressed separately.

Specific problem areas are also apparent in table 9. For example, although both the Pacific Coast and Plains and Rockies had a large high-cost component, the high costs in the Pacific Coast were on moderate to highly productive sites. The higher costs in the Plains and Rockies, however, were predominantly on poor sites. The small tracts in the Northeast and Lake States were frequently treated at low or moderate costs, but a large proportion of the small tracts were on poor sites. Similarly, while a major share of the acres treated in the Central region involved low costs, they also involved intermediate oak-hickory treatments on poor sites. The high-cost component in the South is also clear in table 9, but it typically involves site preparation and planting practices, most of which may be acceptable except on poor sites.

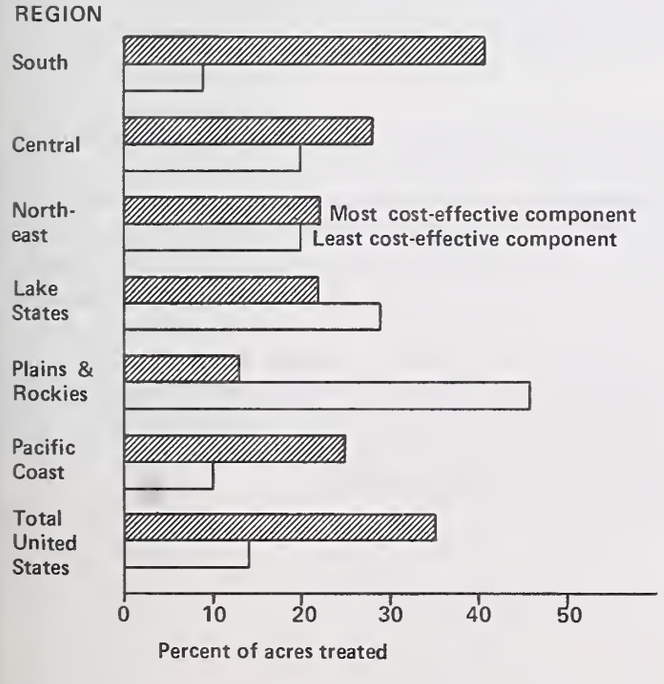


Figure 4.—Percentage of acres treated in the "most" and "least" cost-effectiveness components.

Net Impact of FIP on the Level of Forestry Investment

One question invariably raised in discussions of assistance programs is whether the program has any net impact upon investment activity. There is no easy or cheap way to accurately estimate net program impact.

Roughly half of the Agricultural Conservation Program (ACP) recipients in Michigan questioned by Yoho and James (1958) said they would have undertaken the forestry practice in spite of the cost-share. About 70 percent of the REAP tree planting participants in Minnesota questioned by Gregersen et al. (1975) said they still would have undertaken the practice if a smaller Federal cost-share was provided. It is difficult, however, for a recipient to conclude what he would have done in a situation which he never faced.

Gregersen et al. (1975) estimated that 41 percent of the REAP recipients they studied could have earned their alternative rate of return without a Federal cost-share, and imply that the reason the investments had previously gone begging was the lack of technical assistance. A substantial divergence between the owner's goals and the goal of financial maximization may also explain these results.

From 1970 to 1972, REAP tree planting constituted over 50 percent of the acres planted on nonindustrial private lands (USDA-ASCS 1973, and previous issues; USDA-FS 1973a, and previous issues). This does not prove, however, that acreage was treated only because the assistance program was offered.

In Westat's (1972) study of the Cooperative Forest Management (CFM) program, a positive correlation between percentage Federal cost-share rate and practice adoption was observed. A 10 percent increase in cost-share rate led to an estimated 5 percent increase in adoption rate.

The question of net program impact is simply not easy to answer.

CONCLUSIONS AND RECOMMENDATIONS

Data for the first-stage evaluation indicates that 1974 FIP generally performed well in meeting its primary goal of cost-effective timber production. Some low-performance components were identified, but this is not surprising for the first-year offering of a substantial assistance program delivered through three cooperating agencies.

Although the problem areas were not large and there are some explanations, any poor investments detract from the program goal. Also, since some intermediate treatments may not be applied and some plantings may not be retained until maturity, as many problems as possible should be eliminated before the initial investments are committed.

The ideal way to eliminate problem areas before the initial investment stage is to use a capital budgeting approach. First, the financial return of stylized investment cases covering a range of practices, sites, and costs would be estimated. The stylized cases would subsequently be ranked by financial return, so that the ranking could be used to set the priority of FIP applicants. The ranking could also be used to determine which applicants should be denied because they fail to show an acceptable return (such as 5 percent).

Webster (1960) constructed a capital budget ranking of timber investments in Pennsylvania. Colorado has proposed using this approach for FIP, and some southern States are using a similar mechanism for setting maximum cost levels. This approach should be encouraged in States where a restricted number of practices, forest types, and sites are encountered.

While desirable, it is questionable if a nationwide ranking of even stylized investment cases could be developed. The diversity of investments is too great, and existing data are too poor. The approach is also administratively awkward unless there is a large backlog of applications.

An alternative approach to investment ranking is establishment of maximum and minimum standards on the crucial cost-effectiveness indicators. There is a danger of excluding some good investments by such an approach, but the most unfavorable ones can be avoided and the standards are relatively simple administratively. One step in this direction was taken at the inception of FIP when sites below 50-cubic-foot production potential were excluded. Performance data from the first-stage evaluation of 1974 FIP provide the base for four recommendations. Although the recommendations are basic to cost-effective timber production, they may require modification after the second and third stages of the evaluation are completed.

Recommendation 1.—A minimum tract size of 10 acres should be established. The only exception might be for treatment of high-quality hardwoods such as black walnut.

In 1975 the States were asked to establish their own minimum size standards. The response was not encouraging. A few States set minimums of 10 acres or more, but most established a very low minimum. The response for 1976 tract size limitations is more encouraging. Most of the States set a 10-acre minimum. If a 10-acre minimum had been in force in 1974, not only would numerous less desirable investments have been excluded, but the average tract size for 1974 FIP would have been 29 acres for site preparation and/or planting and 28 acres for intermediate treatments—over four times as large as the average tree planting tract size for 1972 REAP.

Under normal circumstances, it probably would not be politically feasible to exclude participants by means of a minimum tract size. FIP is currently administered side-by-side with the forestry practices of ACP, however, and funding for both is handled by the same agency, ASCS. The small tracts could be picked up under ACP's soil and water conservation goal. Congress has already expressed the view that FIP should not be viewed as a substitute for ACP forestry practices (U.S. Congress 1975). Differences in the administrative structure of the two programs—especially county versus national program control—sometimes hampers the flow of cases from FIP to ACP. This problem needs to be recognized and overcome.

Recommendation 2.—Maximum per-acre cost levels should be established in accordance with (a) what will yield acceptable financial returns, and (b) the availability of lower cost investments.

Many States have voluntarily implemented maximum cost standards based upon financial return studies, but a more consistent nationwide standard is necessary. The guide for acceptable returns could be tied to the interest rate on certain U.S. Treasury notes, as is done in the evaluation of water projects.

Variation of per-acre treatment costs within and between some States is greater than can be readily explained by available information on geographic cost variations. Since within-State cost variation is positively correlated with higher average costs, the explanations should be found.

Recommendation 3.—Determine the causes of the within- and between-State cost variation.

The first step of the study may entail documenting differences in labor and equipment costs, determining the relative availability of vendor services, and analyzing the terrain impact upon costs. The second step may be an evaluation of how Federal cost-share levels are set at the State and county levels, since some of the cost variation may be the result of lax cost controls.

The procedure for apportioning Federal cost-share funds among the States, which was developed in 1973 and applied in the 1974, 1975, and 1976 programs, used estimates of the relative investment potential among the States. Although some allocation problems occurred, it is a defensible and objective procedure which used the best available data. Information developed for the first-stage evaluation of 1974 FIP may help overcome some problems in allocations of FIP funds among the States.

Recommendation 4.—Develop a new apportionment procedure which incorporates information on the relative ability to deliver the program and the cost effectiveness of the program delivered, as well as relative investment opportunities among States.

The apportionment should be developed as an objective and well-documented procedure, so it does not evolve piecemeal in response to pressures from individual States. It should also be constructed to incorporate the most recent information available on State performance.

No analytical apportionment procedure could possibly contain all of the factors which should be considered in the management of a program like FIP. Therefore, some flexibility beyond the apportionment procedure is needed. The reasons for invoking the flexibility should be well understood, however, to avoid inconsistency.

Implementing any of these recommendations will not be easy because some States will receive lower allocations than they have in the past. Acceptance of these recommendations, however, should help sharpen the focus of FIP on its primary goal of cost-effective timber production.

LITERATURE CITED

Anderson, Walter C.
1968a. Factors influencing North Carolina landowners to practice forestry. USDA For. Serv. Res. Pap. SO-33, 18 p. South. For. Exp. Stn., New Orleans, La.

Anderson, Walter C.
1968b. Rating investments for improving Georgia timber stands. Land Econ. 44(1):121-127.

Anderson, Walter C.
1969. Determinants of southern pine pulpwood prices. USDA For. Serv. Res. Pap. SO-44, 10 p. South. For. Exp. Stn., New Orleans, La.

Anderson, Walter C.
1975. Timber stand improvement: An entree to forestry for small-tract owners. J. For. 73(4):222-223.

Anderson, Walter C., and Sam Guttenberg.
1971. Investor's guide to converting southern oak-pine types. USDA For. Serv. Res. Pap. SO-72, 10 p. South. For. Exp. Stn., New Orleans, La.

Balmer, William E., and Hamlin L. Williston.
1973. The need for precommercial thinning. For. Manage. Bull Unnumbered, 6 p. U.S. Dep. Agric., For. Serv. SE Area, State Private For., Atlanta, Ga.

Benson, Robert, and Richard A. Skok.
1960. The Soil Bank Act and its forestry impacts in Minnesota. J. For. 58(12):937-942.

Beuter, John H., and Jeffrey K. Handy.
1974. Economic guidelines to reforestation for different ownerships: A case study for the Coast Range of Western Oregon. Oreg. State Univ. Sch. For., Res. Pap. 23, 69 p. Corvallis.

Callahan, John C., and Robert P. Smith.
1974. An economic analysis of black walnut plantation enterprises. Purdue Univ., Agric. Exp. Stn. Res. Bull. 912, 20 p. Lafayette, Ind.

Callahan, John C., and Robert W. Wenger.
1973. An assessment of the financial consequences of public subsidies on privately owned, previously unmanaged, upland oak woodland enterprises in Indiana. Purdue Univ., Agric. Exp. Stn. Res. Bull. 902, 15 p. Lafayette, Ind.

Conkin, Merle E.
1971. Cost of timber management for selected areas in the northern region of the United States. M.S. Thesis. Iowa State Univ., Ames. 103 p.

Duerr, William A.
1974. Timber supply: Goals, prospects, problems. Am. J. Agric. Econ. 56(5):927-935.

Dutrow, G. F., J. S. McKnight, and S. Guttenberg.
1970. Investment guide for cottonwood planters. USDA For. Serv. Res. Pap. SO-59, 15 p. South. For. Exp. Stn., New Orleans, La.

Gansner, David A., and Owen W. Herrick.
1973. The timber supply potential of intensive management in upland oak forests of Ohio. USDA For. Serv. Res. Pap. NE-271, 8 p. Northeast. For. Exp. Stn., Upper Darby, Pa.

Gregersen, H., T. Houghtaling, and A. Rubinstein.
1975. Economics of public forestry incentives programs: A case study of cost-sharing in Minnesota. 138 p. Univ. Minn., St. Paul.

Guttenberg, Sam.
1970. Case for precommercial thinning. For. Farmer 29(11):13, 18.

Herrick, Owen W.
1975. A profile of logging in the Northeast, part II. North Logger Timber Process. 24(5):20-21.

Herrick, Owen W., and J. Edwin Morse.
1968. Investment analysis of stand improvement and reforestation opportunities in Appalachian forests. USDA For. Serv. Res. Pap. NE-111, 43 p. Northeast. For. Exp. Stn., Upper Darby, Pa.

James, Lee M., and Con H. Schallau.
1961. Forestry practices under the Agricultural Conservation Program. Land Econ. 37:142-149.

Kingsley, Neal P., and Carl E. Mayer.
1972. The extent, composition, and general condition of northern conifer plantations in the Northern Region. 16 p. [Presented at Conf. on Utilization of Plantation Grown Northern Softwoods, State Univ., N.Y., Col. Environ. Sci. For., Syracuse Univ., Syracuse, N.Y., Sept. 6-7, 1969.]

Knight, Herbert A., and Joe P. McClure.
1974. Opportunities for increasing timber supplies in the Southeast. USDA For. Serv. Resour. Bull. SE-28, 16 p. Southeast. For. Exp. Stn., Asheville, N.C.

Lewis, Gordon D., and Daniel E. Chappelle.
1964. Farm woodland management cost and returns in the Southern Piedmont of Virginia. USDA For. Serv. Res. Pap. SE-15, 20 p. Southeast. For. Exp. Stn., Asheville, N.C.

Lundgren, Allen L.
1966. Estimating investment returns from growing red pine. USDA For. Serv. Res. Pap. NC-2, 48 p. North Central For. Exp. Stn., St. Paul, Minn.

MacLean, Colin D., and Charles L. Bolsinger.
1973. Estimating productivity on sites with a low stocking capacity. USDA For. Serv. Res. Pap. PNW-152, 18 p. Pac. Northwest For. and Range Exp. Stn., Portland, Oreg.

MacLean, Colin D., and Charles L. Bolsinger.
1974. Stockability equations for California forest land. USDA For. Serv. Res. Note PNW-233, 10 p. Pac. Northwest For. and Range Exp. Stn., Portland, Oreg.

McCauley, Orris D., and David A. Marquis.
1972. Investment in precommercial thinning of northern hardwoods. USDA For. Serv. Res. Pap. NE-245, 13 p. Northeast. For. Exp. Stn., Upper Darby, Pa.

Mann, W. F., and R. E. Lohrey.
1974. Precommercial thinning of southern pines. J. For. 72(9):557-560.

Manthy, Robert S.
1970. An investment guide for cooperative forest management in Pennsylvania. USDA For. Serv. Res. Pap. NE-156, 59 p. Northeast. For. Exp. Stn., Upper Darby, Pa.

Manthy, R. S., C. D. Rannard, and V. J. Rudolph.
[n.d.] The profitability of red pine plantations. Mich. Agric. Exp. Stn., Res. Rep. 11, 12 p. East Lansing, Mich.

Mendel, Joseph L.
1967. Forestry accomplishments in southeastern Ohio under the U.S. Agricultural Conservation Program, 1957-64. USDA For. Serv. Res. Pap. NE-65, 26 p. Northeast. For. Exp. Stn., Upper Darby, Pa.

Mills, Thomas J.
1975. Investment priorities for small-owner assistance programs. J. For. 73(4):210-213.

Mills, Thomas J., Thomas P. Hart, and J. S. McKnight.
1974. Forestry incentives: How funds were apportioned to States in 1974. J. For. 72(8):478-482.

Moak, James E., and James M. Kucera.
1975. Current costs and cost trends for forestry practices in the South. For. Farmer 34(5):75-82.

Nadeau, Jean-Paul.
1970. Economics of reforestation. For. Chron. 46(6):3-6.

Row, Clark.
1973. Probabilities of financial returns from Southern pine timber growing. Ph.D. Diss. Tulane Univ., New Orleans. 428 p.

Row, Clark.
1974. Effect of tract size on financial returns in forestry. IUFRO Conf. Proc. C. R. Silversides (ed.), Can. For. Serv., Ottawa, Can. p. 105-136.

Sikes, Robert.
1973. Testimony. **In** hearings before Subcomm. on For., Comm. Agric., U.S. House Rep., May 21-24, 1973, p. 4-14.

South, Donald R., Thomas Hansbrough, and Alvin L. Bertrand.
1965. Factors relating to the adoption of woodland management practices. La. State Univ., Agric. Exp. Stn. Bull. 603, 23 p. Baton Rouge.

Sunda, Henry J., and Gerald L. Lowry.
1975. Regeneration costs in loblolly pine management. J. For. 74(5):406-409.

U.S. Congress.
1973. Agriculture and Consumer Protection Act. (PL 93-86). Title X, Sect. 1009, 1010.

U.S. Congress.
1975. House of Representatives report on the Agriculture and Related Agencies Appropriation Bill, 1976. Report accompanies H.R. 8561.

U.S. Department of Agriculture, Agricultural Stabilization and Conservation Service.
1973. 1972 Rural Environmental Assistance Program. 111 p. Wash. D.C.

U.S. Department of Agriculture, Agricultural Stabilization and Conservation Service.
1974. Rural Environmental Conservation Program: Development general provisions (1-RE), amend. 3. 25 p. Wash. D.C.

U.S. Department of Agriculture, Forest Service.
1973a. Forest and windbarrier planting and seeding in the United States, July 1, 1972-June 30, 1973. 13 p. Wash. D.C.

U.S. Department of Agriculture, Forest Service.
1973b. The outlook for timber in the United States. For. Resour. Rep. 20, 367 p.

U.S. Department of Agriculture, Forest Service.
1974. Forestry incentives program 1974: Guidelines to state foresters. Div. Coop. For., 17 p. SE Area, State and Private For., Atlanta, Ga.

U.S. Department of Agriculture, Secretary of Agriculture.
1973. Rural environmental conservation program. Secr. memo. 1829, 5 p.

U.S. President.
1973. Statement of the President. Off. White House Press Secr., August 10, 1973, 3 p.

U.S. President's Advisory Panel on Timber and the Environment.
1973. Report. 541 p. Sup. Doc., U.S. Gov. Print. Off., Wash. D.C.

Wallace, Oliver P., and Richard D. Hopkins.
1968. Estimated financial returns from two white pine plantations. N.H. Agric. Exp. Stn. Bull. 496, 24 p. Durham, N.H.

Webster, Henry H.
1960. Timber management opportunities in Pennsylvania. U.S. Dep. Agric., For. Serv., Northeast For. Exp. Stn., Pap. 137, 37 p. Upper Darby, Pa.

Webster, Henry H., and Carl H. Stoltenberg.
1959. What ownership characteristics are useful in predicting response to forestry programs? Land Econ. 35(3):292-295.

Westat, Inc.
1972. Survey and analysis of CFM forestry assistance: Management plans and timber marking assists. Rep. submitted to USDA For. Serv., Wash. D.C. 139 p.

Wikstrom, J. H., and J. R. Alley.
1967. Cost control in timber growing on the National Forests in the Northern Region. USDA For. Serv. Res. Pap. INT-42, 37 p. Intermt. For. and Range Exp. Stn., Ogden, Utah.

Williston, Hamlin L.
1972. The question of adequate stocking. Tree Planters Notes 23(1):9-10.

Williston, Hamlin L., and T. R. Dell.
1974. Growth of pine plantations in north Mississippi. USDA For. Serv. Res. Pap. SO-94, 15 p. South. For. Exp. Stn., New Orleans, La.

Worley, David P., and Hoyt A. Wheeland.
1968. An economic evaluation of cull-tree removal in mixed hardwood stands. USDA For. Serv. Res. Note NE-82, 5 p. Northeast. For. Exp. Stn., Upper Darby, Pa.

Wyoming Forest Study Team.
1971. Forest management in Wyoming. 81 p. U.S. Dep. Agric., For. Serv., Wash., D.C.

Yoho, James G., and Lee M. James.
1958. Influence of some public assistance programs on forest landowners in Northern Michigan. Land Econ. 34(4):357-364.

Zivnuska, John A.
1974. Forestry investments for multiple-uses among multiple ownership types. Resources for the Future Forum on Policy in the Future, Wash. D.C., May 8-9, 1974, 59 p.

Mills, Thomas J.
1976. Cost effectiveness of the 1974 Forestry Incentives Program. USDA For. Serv. Res. Pap. RM-175, 23 p. Rocky Mt. For. and Range Exp. Stn., Fort Collins, Colo. 80521.

The Forestry Incentives Program (FIP) is a new cost-sharing program different from its predecessors in that its primary goal is the cost-effective production of timber rather than soil and water conservation in general. The first-year (1974) performance of FIP is analyzed with respect to four indicators of cost effectiveness: the practice and forest type to which it is applied, tract size, total cost per acre, and site class. The performance on the majority of the acres treated was good. Four recommendations are made which should minimize specific problems and further enhance FIP's ability to produce timber cost effectively.

Keywords: Forest economics, Forestry Incentives Program, farm forestry, investments (timber).

Mills, Thomas J.
1976. Cost effectiveness of the 1974 Forestry Incentives Program. USDA For. Serv. Res. Pap. RM-175, 23 p. Rocky Mt. For. and Range Exp. Stn., Fort Collins, Colo. 80521.

The Forestry Incentives Program (FIP) is a new cost-sharing program different from its predecessors in that its primary goal is the cost-effective production of timber rather than soil and water conservation in general. The first-year (1974) performance of FIP is analyzed with respect to four indicators of cost effectiveness: the practice and the forest type to which it is applied, tract size, total cost per acre, and site class. The performance on the majority of the acres treated was good. Four recommendations are made which should minimize specific problems and further enhance FIP's ability to produce timber cost effectively.

Keywords: Forest economics, Forestry Incentives Program, farm forestry, investments (timber).

Mills, Thomas J.
1976. Cost effectiveness of the 1974 Forestry Incentives Program. USDA For. Serv. Res. Pap. RM-175, 23 p. Rocky Mt. For. and Range Exp. Stn., Fort Collins, Colo. 80521.

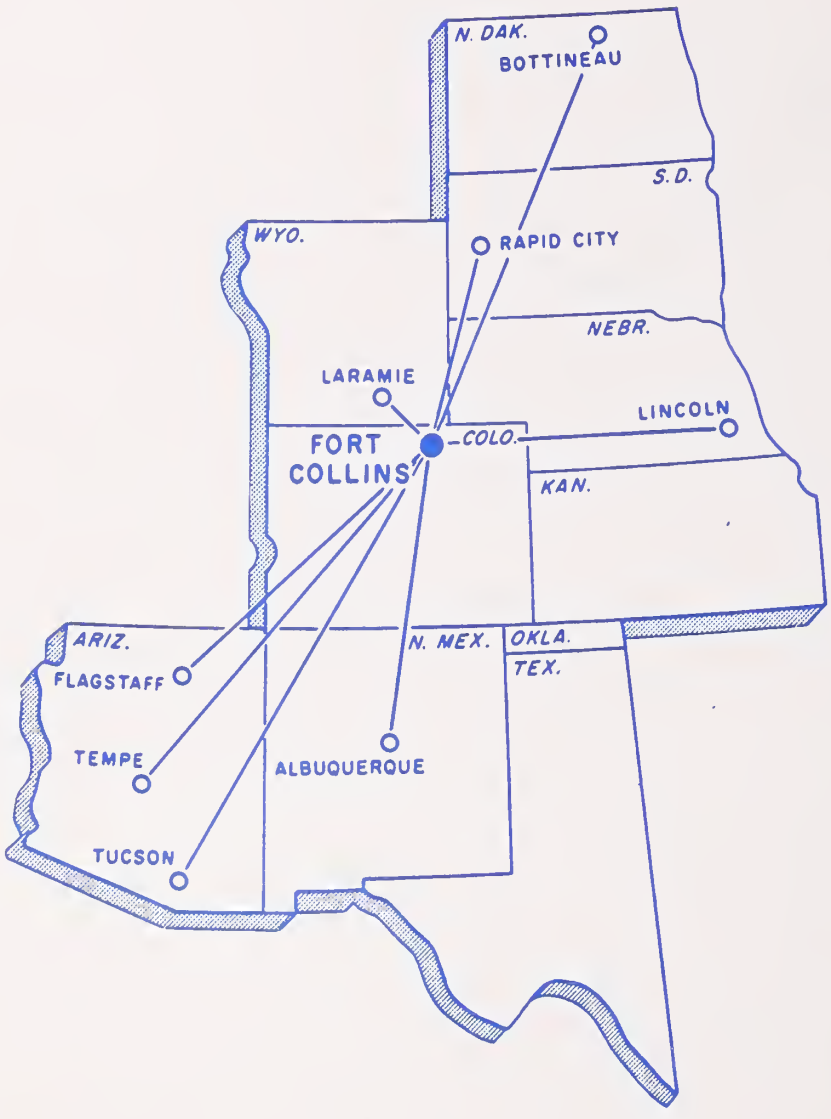
The Forestry Incentives Program (FIP) is a new cost-sharing program different from its predecessors in that its primary goal is the cost-effective production of timber rather than soil and water conservation in general. The first-year (1974) performance of FIP is analyzed with respect to four indicators of cost effectiveness: the practice and forest type to which it is applied, tract size, total cost per acre, and site class. The performance on the majority of the acres treated was good. Four recommendations are made which should minimize specific problems and further enhance FIP's ability to produce timber cost effectively.

Keywords: Forest economics, Forestry Incentives Program, farm forestry, investments (timber).

Mills, Thomas J.
1976. Cost effectiveness of the 1974 Forestry Incentives Program. USDA For. Serv. Res. Pap. RM-175, 23 p. Rocky Mt. For. and Range Exp. Stn., Fort Collins, Colo. 80521.

The Forestry Incentives Program (FIP) is a new cost-sharing program different from its predecessors in that its primary goal is the cost-effective production of timber rather than soil and water conservation in general. The first-year (1974) performance of FIP is analyzed with respect to four indicators of cost effectiveness: the practice and forest type to which it is applied, tract size, total cost per acre, and site class. The performance on the majority of the acres treated was good. Four recommendations are made which should minimize specific problems and further enhance FIP's ability to produce timber cost effectively.

Keywords: Forest economics, Forestry Incentives Program, farm forestry, investments (timber).


N. DAK.
BOTTINEAU
S.D.
WYO.
RAPID CITY
NEBR.
LARAMIE
LINCOLN
FORT COLLINS
COLO.
KAN.
ARIZ.
N. MEX.
OKLA.
TEX.
FLAGSTAFF
TEMPE
ALBUQUERQUE
TUCSON